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(58) Field of search

**UK CL (Edition K) H1N NBH NPKD NQC NUJA
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(54) **A switch keyboard for the control panel of an electrical appliance**

(57) A keyboard comprises keys (1), projecting from respective housings (2) formed in the front wall (3) of a control panel 1 of an electrical appliance. The keys are made by moulding in a silicone sheet (4) and each has one end (5) bearing a conducting zone (6) arranged to face two electric contacts (7) on a printed circuit plate (8), the key being mounted to be movable over a predetermined extent of travel (d). The external surface (17) of the front wall (3) is covered by a membrane (18) made of semi-rigid plastics material and comprising, facing each housing (2), a blister (19) having the shape of a spherical cap the height (h) of which is equal to or slightly greater than the predetermined extent of travel (d) of the key.

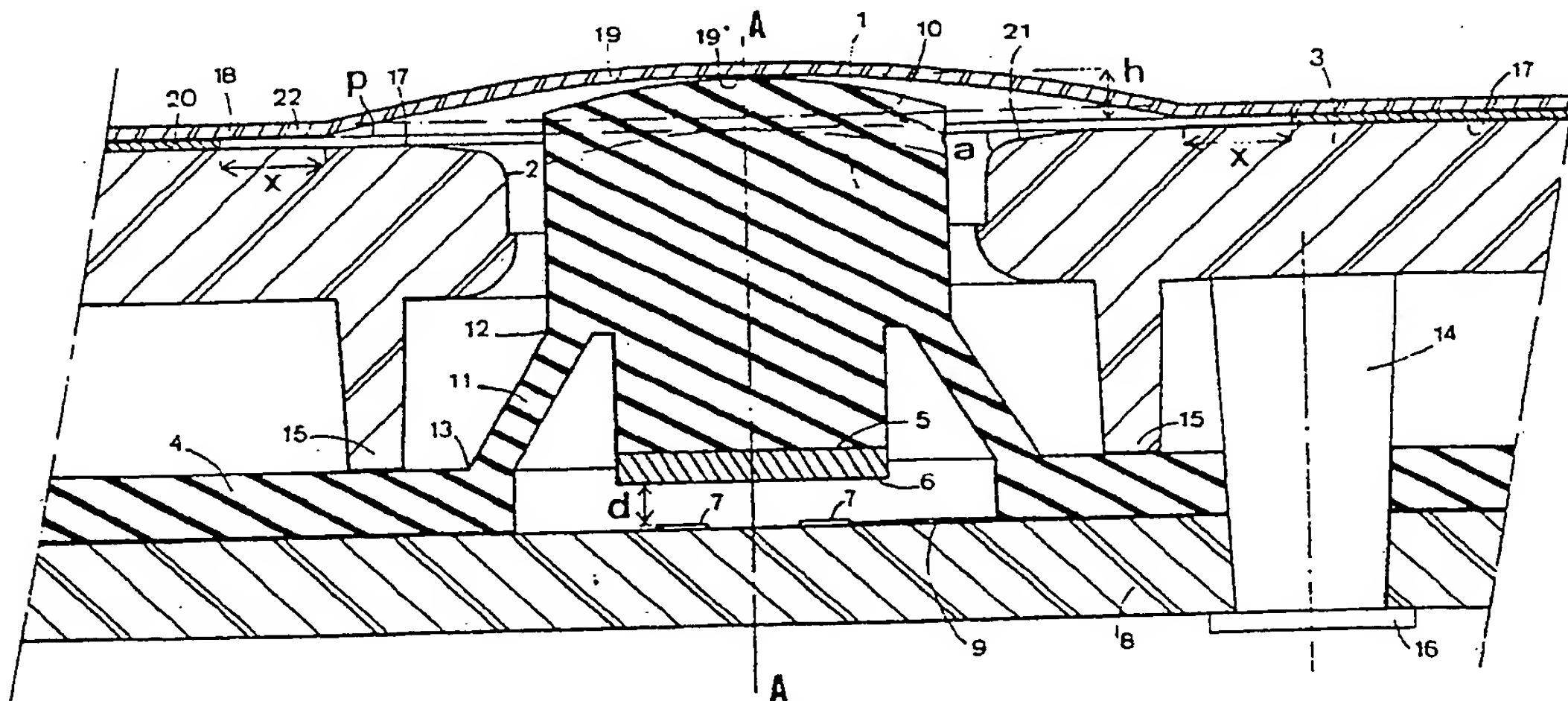


FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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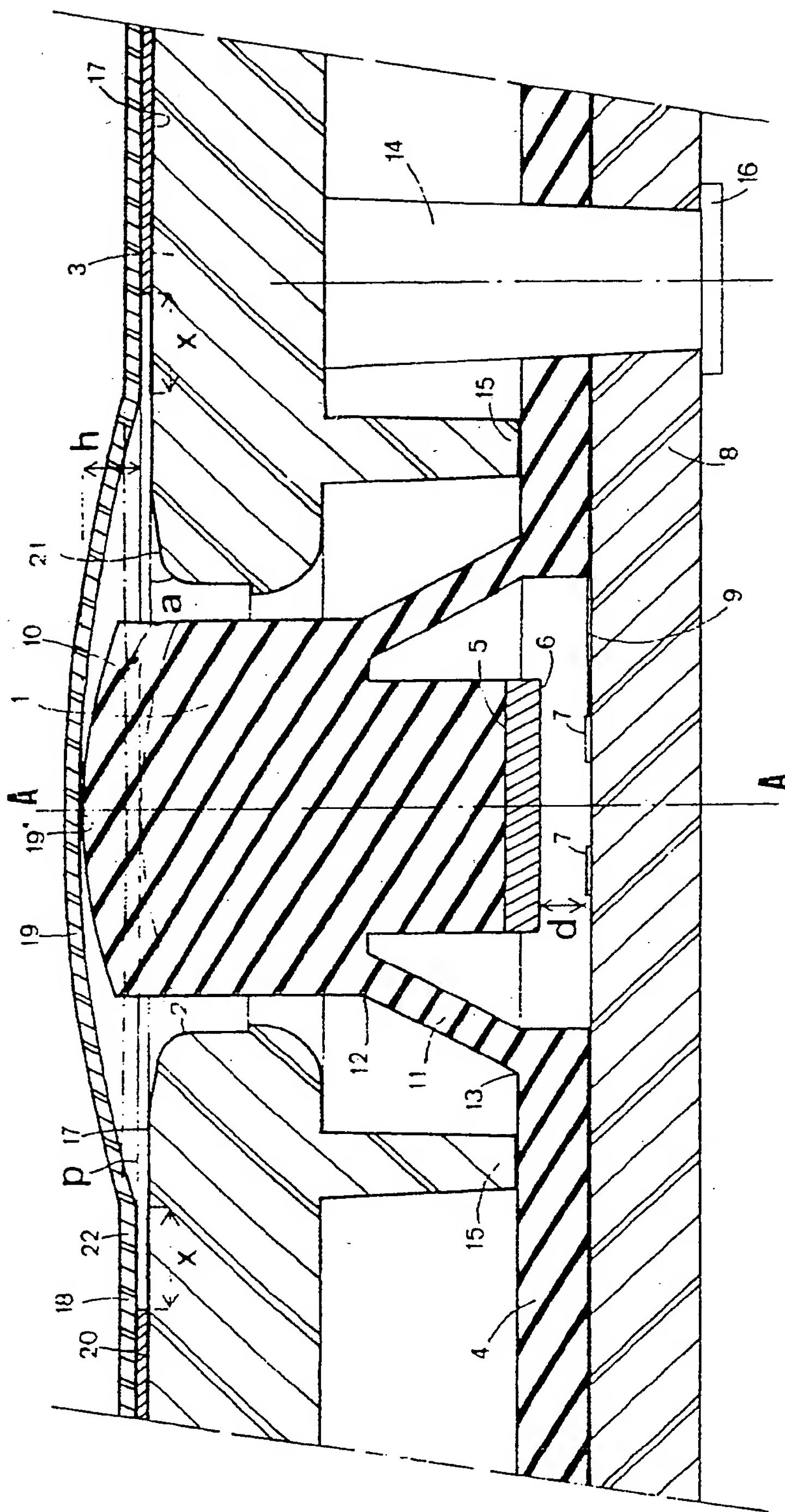


FIG. 1

A SWITCH KEYBOARD FOR THE CONTROL PANEL OF AN ELECTRICAL APPLIANCE

The invention relates to a switch keyboard for the control panel of an electrical appliance, comprising a plurality of keys projecting slightly from respective housings formed in the front wall of the panel and made by moulding in a sheet of elastic insulating material such as a silicone, each key having one end bearing a conducting zone arranged to face two contacts located on a plate comprising a printed circuit, and another end forming the region for pressing, each key being mounted to be movable in a direction perpendicular to the said plate over a predetermined extent of travel by means of a tapered skirt, the small end of which is connected to the central region of the key and the large end of which is joined to the insulating sheet.

The aim of the invention is to improve not only the sealing of these keyboards but also their electrical operation whilst providing the user with a tactile sensation of the correct operation of the switch key, this being particularly important when the keyboard is intended to be used to control the different operations of a microwave oven for domestic use.

According to the invention, the external surface of the front wall of the panel is covered by a membrane made of semi-rigid plastics material and comprising, facing each housing of a key, a blister having the shape of a spherical cap convex towards the outside, the height of which cap is equal to or slightly greater than the predetermined extent of travel of the key.

Thanks to this construction of the membrane, not only is a sealed protection of the electrical components of the control panel obtained, but a supple operation of the keys is obtained which is very attractive to the user and which makes it possible to obtain, thanks to the blisters, a positive action type of effect so far as the electrical contacts are concerned.

According to one embodiment of the invention, the semi-rigid plastic material of the membrane is a copolymer of polycarbonate and polyester.

Thanks to the use of this kind of material, blisters are obtained with elasticity characteristics which remain reliable with time, and it is also possible to perform direct printing, of an indelible nature, on the said blisters.

Embodiments of the invention are described below with reference to the accompanying drawing, in which:

FIGURE 1 is a partial view in vertical section and on a large scale of a switch keyboard for a control panel, illustrating more particularly a key forming a switch in accordance with the invention.

This switch keyboard for a control panel is adapted to equip an electrical appliance such as, for example, a microwave oven, and comprises for this purpose a plurality of identical keys 1 which project slightly from respective housings 2 formed in the front wall 3 of the control panel and which are made by moulding in a sheet 4 of elastic insulating material such as, for example, silicone,

As shown in Figure 1, each key 1 has one end 5 bearing a conducting zone 6 made of a conducting material, for example a silicone containing carbon, situated facing two contacts formed by studs 7 located on a plate 8 comprising a printed circuit 9 and another end 10 forming the region for pressing; the said key 1 being mounted to be movable in a direction perpendicular to the plate 8 over a predetermined extent of travel d by means of a tapered skirt 11, the small end 12 of which is connected to the central region of the key 1 and the large end 13 of which is joined to the insulating sheet 4.

The plate 8 and the sheet 4 are assembled on the front wall 3 by means of rivets 14 which are fixed to the front wall 3 and which pass through the sheet and the plate, and which are adapted to cause the plate 8 and the sheet 4 to become clamped between the ends of ribs 15, which are also fixed to the front wall 3, and the heads 16 of the rivets 14.

The external surface 17 of the front wall 3 of the panel is covered by a membrane 18 made of semi-rigid plastic material consisting of a copolymer of polycarbonate and polyester known by the commercial name "Bayfol" (registered trademark of the firm BAYER AG); the membrane comprising, facing each housing 2 of a key 1, a blister 19 having the shape of a spherical cap convex towards the outside, the height (h) of which, measured on the straight vertical line A-A passing through its summit region, is equal to or slightly greater than the predetermined extent of travel (d) of the key 1.

In the preferred embodiment the ideal extent of travel is equal to 0.7 mm and the plastic material, given the reference name BAYFOL K L 3-1010 by BAYER, has a thickness of about 175 μ and receives on its external surface, and even on the blisters, printing showing the different functions of the keys 1.

In addition, in order to allow in the course of time good operation of the blisters without permanent deformation, it has been found that the ratio of the height (h) of the cap to the diameter of its bottom polar circle (p) should be between 0.06 and 0.07. This ratio should be regarded as important since the membrane made of "Bayfol" shows substantially no extensibility and the extent of travel of the key should be relatively large in order to avoid unintended contacts during a slight touching pressure on this membrane.

In order to ensure the sealing of the control panel and firm holding of the membrane on the front wall 3, whilst improving the ease of inverting the blisters, this membrane is glued on the external

surface 17 of the front wall 3 by means of a layer of adhesive 20, having a thickness of 250 μ for example, the adhesion zone ending around each blister 19 at a predetermined distance \underline{x} from the corresponding bottom polar circle \underline{p} . This distance \underline{x} is approximately equal to or less than an eighth of the diameter of the said bottom polar circle \underline{p} .

Furthermore, in order to ensure the linear guiding of the concave summit region of the dome during a touch pressure along the axis A-A, the housing 2 of each key 1 comprises a mouth with a flared edge 21. In order to avoid a permanent inversion of the blister, this flared edge 21 should have a slope (\underline{a}) of less than 9° and preferably equal to 8° (eight degrees).

On the other hand, in order to favour the commencement of inversion of the blister and depression of the key 1, the region for pressing 10 of each key 1 has the shape of a dome such that it is in localized contact with the concave summit region 19' of the spherical cap.

The switch keyboard operates as follows : when a touch pressure is applied to the summit region 19' of a blister 19, in a first stage a slight depression of the border 22 facing the zone which is not glued is caused, then the depression of the said summit region 19', which bears locally on the summit of the dome 10 of the key 1, and which transmits the touch pressure to the said key in a substantially linear manner, is caused, and in a second stage the sudden inversion of the blister 19, until its concave face abuts on the flared edge 21 of the mouth of the housing, occurs.

This abrupt movement amplifies the touch pressure and causes, in a known way, the elastic deformation of the tapered skirt 11 and the abrupt depression of the key 1 thus causing the abrupt transitory closing of the switch by the contact of the conducting zone 6 on the two studs 7, thus avoiding the formation of an electric arc.

When the touch pressure on the blister 19 is released, (thanks to the flared edge 21 of the mouth being limited to 8 degrees the inversion of the blister is not permanent) the blister resumes its initial convex shape thus releasing the key 1 which, as a result of the action of the opposite deformation of the tapered skirt 11, returns to its open position shown in Figure 1.

CLAIMS

1. A switch keyboard for the control panel of an electrical appliance comprising a plurality of keys (1) projecting slightly from respective housings (2) formed in the front wall (3) of the panel and made by moulding in a sheet (4) of elastic insulating material such as a silicone, and each key having one end (5) bearing a conducting zone (6) arranged to face two contacts (7) located on a plate (8) comprising a printed circuit (9), and another end (10) forming the region for pressing; each key (1) being mounted to be movable in a direction perpendicular to the plate (8) over a predetermined extent of travel (d) by means of a tapered skirt (11), the small end (12) of which is connected to the central region of the key and the large end (13) of which is joined to the insulating sheet (4); wherein the external surface (17) of the front wall (3) of the panel is covered by a membrane (18) made of semi-rigid plastics material and comprising, facing each housing (2) of a key (1), a blister (19) having the shape of a spherical cap convex towards the outside, the height (h) of which is equal to or slightly greater than the predetermined extent of travel (d) of the key (1).

2. A switch keyboard according to Claim 1, wherein the semi-rigid plastics material of the membrane (18) is a copolymer of polycarbonate and polyester.

3. A switch keyboard according to Claim 1 or 2, wherein the ratio of the height (h) of the cap (19) to the diameter of its bottom polar circle (p) is between 0.06 and 0.07.

4. A switch keyboard according to any one of the preceding Claims, wherein the region for pressing (10) of each key (1) has the shape of a dome such that it is in localized contact with the concave summit region (19') of the spherical cap (19).

5. A switch keyboard according to any one of the preceding Claims, wherein the membrane (18) is glued on the external surface (17) of the front wall (3) of the panel, over an adhesion zone (20) ending around each blister (19) at a predetermined distance (x) from the corresponding bottom polar circle (p), this distance (x) being approximately equal to or less than an eighth of the length of the diameter of the bottom polar circle.

6. A switch keyboard according to any one of the preceding Claims, wherein the housing (2) of each key (1) comprises a mouth with a flared edge (21).

7. A switch keyboard according to Claim 6, wherein the flared edge (21) has a slope (a) of less than nine degrees and preferably equal to eight degrees.

8. A switch keyboard substantially as described herein with reference to the accompanying drawing.